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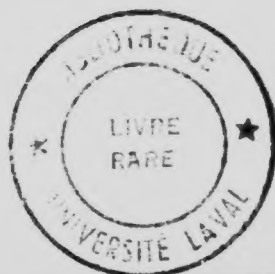
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# Rapid Figuring

Including  
Over Seventy Short Cuts  
and Other Useful  
Facts

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## PREFACE



THIS little book on Rapid Calculation is intended to show how one may become *Accurate* and *Rapid* in figuring. It is arranged for use in Schools and Colleges or for private individuals. A practice pad of 50 lessons accompanies it—the lessons being carefully graded. The pad may be used as homework or schoolwork, at the teacher's discretion.

The number of students who can add accurately, even at the slow rate of 30 figures per minute, are deplorably few, whereas every person who has reached the age of 15 years should acquire a speed of from 100 to 120 figures per minute. They should read figures in groups as they read letters in words. The drills here given in figure reading, in addition, subtraction and multiplication, are an excellent means for obtaining this result.

The short cuts, too, are invaluable to any ambitious youth. Much time is often wasted using pencil and paper when the work could be done infinitely quicker mentally.

What is presented here is the result of over 20 years of experience with this important subject. The methods used have been carefully tried out and proven effective before offering them to the public. The book is, without question, a veritable gold mine to any one who will master it. It means "*Work*," most certainly, but work that will surely bring *Results*.

THE AUTHOR



## Addition

Addition is done only when done correctly.  
Addition will always be necessary notwithstanding Adding Machines.

As a precaution against mistakes be careful to write all figures plainly and everyone precisely in its place.  
Learn to make good figures

There are only 45 possible combinations of two figures as seen herewith.

1	2	3	4	5	6	7	8	9	A dull is given at the top of several pages of the pad on these combinations. They should each be read forward and back scores of times until thoroughly mastered
2	2	2	2	2	2	2	2	2	
2	3	4	5	6	7	8	9		
3	3	3	3	3	3	3	3		
3	4	5	6	7	8	9			
4	4	4	4	4	4	4	4		
4	5	6	7	8	9				
5	5	5	5	5	5				
5	6	7	8	9					

## Subtraction

6	6	6	6	These same exercises may also be used for drill in subtraction by reading the differences.
6	7	8	9	
7	7	7		
7	8	9		

## Multiplication

8	8	By reading the products of these same combinations we get an excellent drill in multiplication.
8	9	
9		
9		

## Our Aim

Our aim should be to take in combinations and results without conscious notice of individual figures and minor process, the same as you read words and sentences without thinking of the letters of which they are composed.

## Single Column Addition

4 | 11 Some reach a fair speed adding  
 7 | but one figure at a time. A great  
 9 | 15 advantage however, is found in  
 6 | learning to read figures as we  
 3 | 11 read letters in words, that is, by  
 8 | grouping two, three or more at a  
 5 | 14 time. The example here given il-  
 9 | lustrates grouping two figures;  
 6 | 10 reading up from the bottom we  
 4 | have, 11-21-35-46-61-72 and.  
 8 | 11 The exercises at the top of the  
 3 | 72 72 lessons, in pad, are given that  
 we may master the 40 combinations of  
 2 figures. Much drilling is necessary.  
 This grouping should be taken in at a  
 glance. To add 10, 11, 12, 13 etc. should  
 require little more mental effort than  
 adding 1, 2, 3-4 etc., to a number.

## Two Column Addition

21 Reading from the bottom up we  
 17 first add the tens then the units  
 32 and as on to the top. Thus, begin-  
 18 ning with 42 add 30 = 72 then 4 =  
 40 76 next 20 then 3 and as on. This  
 36 lends itself, certainly to good  
 24 speed and even three or four col-  
 16 umns may be added in this  
 23 manner. One column addition,  
 34 however, is generally most desir-  
 42 able until thoroughly mastered,  
 303 then the two or more column  
 addition may come in.

## Horizontal Addition

Adding across the page is sometimes neces-  
 sary. The 1st exercise on this, in pad, is on page 11.

### Combination Addition

This refers to a method of drill aiming at accuracy and speed in addition. It consists of starting with a given number and adding continuously a certain number until a given limit is reached.

Ex. - Begin with 5 add 7 till 100 is reached  
as 5, 12, 19, 26, 33, 40, 47, 54, 61, 68, 75, 82, 89, 96, 100

Ex - Beginning with 8 add 13 till 200 is reached  
as 8, 21, 34, 47, 60, 73, 86, 99, 112, 125, 138, 151, 164 etc.

Ex - Begin with 4 and add 7 and 11 alternately till 200 is reached as 4, 11, 18, 25, 32 etc.

### Subtraction

Ex - Begin with 100 subtract 7 till 0 is reached as 100, 93, 86, 79, 72, 65, 58, 51 etc.

Ex - Begin with 200 subtract 16 till 0 is reached as 200, 184, 168, 152, 136, 120 etc.

Note - The teacher may introduce other varieties of this class of work.

### Mental Drill

The teacher will find a drill like the following excellent for developing concentration of attention and rapidity

Ex - Take 4, multiply by 7, subtract 3, half it, add 6, take the square root, double it, multiply by 12 take away 4, half it, add 30 and take the square root, answer?

Note - Teacher should use his own discretion in assigning lessons. One page might make 2, or more lessons. Marks should be awarded for each lesson.

2  
3 9 5 5 4 6 9 5 8 6 3 9 4 7 3 6 8 7 9



### Arithmetical Complements

The complement of a number is the difference between that number and the unit of the next higher order.

Ex. Complement of 7 = 3, because  $10 - 7 = 3$

" "  $38 = 62$  "  $100 - 38 = 62$

" "  $725 = 275$  "  $1000 - 725 = 275$

### Making Change

In making change the principle of arithmetical complements may be used

Ex.  $^{\$1.00}$  is given to pay a bill of  $35^c$  the complement of  $35$  would be the change -  $65^c$

Ex.  $^{\$10.00}$  is tendered to pay a bill of  $^{\$2.22}$  the complement of  $^{\$2.22}$  or  $^{\$7.78}$  is the change.

Complements may be found more readily by considering  $^{\$1.00}$  as 9 tens or 10 units, or  $^{\$10.00}$  as 9 hundreds or 10 tens, so that to find complement of, say, 364, we begin at the left to subtract, taking 3 from 9, 6 from 9 and 4 from 10 = 636

Change, however, is usually found by the following method

Ex. For a purchase of  $^{\$3.22}$  a  $^{\$10.00}$  bill is tendered by the customer. The clerk counts out the change beginning at 337 saying 3.40, 3.50, 4.00, 5.00,  $^{\$10.00}$  having handed back 3 one cent pieces - 1 ten cent piece - 1 fifty cent piece 1 dollar bill, and a  $^{\$5.00}$  bill.

An exercise on this is found in part p. 36

### An Explanation

Questions written thus  $\begin{array}{r} 43725 \\ 19386 \end{array}$  are to be subtracted and

questions written thus  $\begin{array}{r} 396728 \\ 76 \end{array}$  are to be multiplied and

if written thus  $\begin{array}{r} 8)469375 \end{array}$  are to be divided.

3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3  
2 9 4 7 5 8 6 3 9 6 8 5 2 7 9 6 8 4

## Balancing Accounts

$\$9472.45$  = total of the large side of Account.  
 $\$427.73$  The remaining figures show  
 $29.46$  the small side of account before  
 $213.50$  being totaled up. The difference  
 $1230.61$  which is given at bottom of  
 $3425.10$  the question is the balance.  
 $223.17$  Question - To subtract from  
 $3922.84$   $\$9472.45$  the sum of the re-  
 maining amounts. Work. - 1st column  
 adds 21; then 21 from 25 (suggested by the 5  
 at top) leaves 4. Set down 4 and carry  
 the 2 (from 2 in 25) to 2nd column which  
 totals 26; 26 from 34 (the next highest num-  
 ber ending in 4) leaving 8. Set down 8 and  
 carry the 3 (from 3 in 34) and etc. This  
 rule may be very convenient and is  
 easily mastered.

Proof. - The balance (or answer) added  
 to the 6 addends will equal top row.

## Civil Service Method of Addition

$54669$   
 $15218$   
 $36425$   
 $45325$   
 $68619$   
 $220256$

The sum of each  
 column is placed  
 out to the right as  
 shown herewith and  
 afterwards added. 36  
 is sum of units col-  
 umn; 12 of tens column etc.

This is a safe method for one  
 likely to be interrupted in the work.

4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4  
 2 8 6 9 3 7 5 8 6 9 4 5 9 7 3 8

## Proving Addition by casting out 9's

	sum	rem.	0	Explanation
472956	= 27	"	8	The sum of the
219464	= 26	"	8	1st line is 37
763928	= 35	"	2	which, when
617483	= 29	"	6	divided by 9,
293748	= 33	"	0	leaves rem. 0;
617283	= 27	"	6	and so on
392748	= 33	"	0	down the ques
637281	= 27	"	0	tion. The ans.
4014291	9/21	9/30		also is totaled
	2-3	3-3		

and the 9's cast out ( $21 \div 9$ ) leaving rem. "3". The extended remainders are then added and the 9's cast out. This rem. must correspond with the rem. when the 9's are cast out of the answer. In actual practice only the remainders are set down, so that little time is lost.

Multiplication, too, may be proven correct in this manner. Multiply the remainders from the Multiplicand and Multiplier, cast out the 9's. Do the same with the answer and the remainders should be the same. Also see P 16.

## Alternating Addition and Subtraction

49728650  
-3829764  
45898886  
+9473679  
55372565  
-8437296  
46935269  
+7396874  
54332143

A rapid change from addition to subtraction and back again to addition and so on requires constant watchfulness and concentration of attention. Questions of this kind are given in the pad and more should be given by the teacher.

Students should carefully and persistently drill on the exercises at the top of the pad pages.

## Quick Addition

$\begin{array}{r} 47235 \\ 52765 \\ 31729 \\ 68271 \\ 41728 \\ 37286 \\ 62714 \\ 57298 \\ 42712 \\ \hline 441728 \end{array}$

You will notice that 8 of the 9 lines of figures total 40,000. When this is added to the 5th line you have the same result as you get by placing the 4 in front of line 5 viz 441728. The grouping is done by making the units figures add 10 and the rest toward the left add 9.

$\begin{array}{r} 52739 \\ 46383 \\ 53127 \\ 74635 \\ 46873 \\ 53617 \\ 47261 \\ 36972 \\ 25365 \\ \hline 436972 \end{array}$

Question 2 shows how intricate the combinations may be made to prevent the student discovering them. Try working out the combinations.

Teachers may find this an excellent method of giving abundant practice in addition as their time is saved in writing the answers.

## Notation

Duillions    Novillions    Octillions    Septillions    Sextillions    Quintillions    Quadrillions    Trillions    Billions    Millions    Thousands  
 987,465,326,748,369,256,371,469,367,859,465,873.  
 When figures extend to the right of the units the same names are used with the addition of a suffix "th", as tenths.

### Roman Notation

I V X L C D M  
 1 5 10 50 100 500 1000

Repeating a letter repeats its value as XX = 20.

When a letter of less value is placed before it takes from the value; if after, it adds to, as XL = 50 - 10; LX = 50 + 10. A bar (—) placed over letter multiplies by 1000 as  $\overline{V}$  = 5000. 2 Bars multiplies by 1,000,000 as  $\overline{\overline{V}}$  = 4,000,000. Study the foll. - 333 = CCC XXXIII; 19 = XIX; 658 = DCLVIII  
9880 =  $\overline{IX}$  DCCCLXXX; 6999159 =  $\overline{V}$  IC MXCIXCLIX

## Squares

$$10^2 = 100$$

$$11^2 = 121$$

$$12^2 = 144$$

$$13^2 = 169$$

$$14^2 = 196$$

$$15^2 = 225$$

$$16^2 = 256$$

$$17^2 = 289$$

$$18^2 = 324$$

$$19^2 = 361$$

$$20^2 = 400$$

$$21^2 = 441$$

$$22^2 = 484$$

$$23^2 = 529$$

$$24^2 = 576$$

$$25^2 = 625$$

$$26^2 = 676$$

$$27^2 = 729$$

$$28^2 = 784$$

$$29^2 = 841$$

$$30^2 = 900$$

Assuming that the tables up to  $12 \times 12$  are mastered next learn the squares as high as 20

In learning the squares from 20 to 30 notice that  $20^2$  &  $30^2$  end with like figures namely '00';  $31^2$  &  $29^2$  each end with '21';  $22^2$  &  $28^2$  with '84' and so on

A few good lively drills on these squares with an occasional review will make the average student master of them.

Next, the Tables up as high as  $19 \times 9$  should be taken up. The one who learns them thoroughly will find them of great assistance in saving time.

## Adding Mixed Numbers

$$14\frac{1}{2} \quad 5$$

$$22\frac{1}{4} \quad 2$$

$$19\frac{3}{8} \quad 3$$

$$14\frac{5}{16} \quad 6$$

$$17\frac{1}{2} \quad 4$$

$$24\frac{7}{8} \quad 7$$

$$113\frac{1}{4} \quad 26 = 3\frac{3}{4} = 3\frac{6}{8}$$

The L. C. M. of the Denominators of the fractions is placed a little above and to the right—in this case it's 8. The number of eighths each fraction equals is then placed to the right

and under the 8. Their sum 26 is called 8ths and when reduced makes  $3\frac{1}{2}$ . The 3 is added to the units column.

$$\begin{array}{cccccccccccccccccccccccc} 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \\ 2 & 9 & 4 & 8 & 3 & 7 & 6 & 8 & 4 & 9 & 3 & 7 & 3 & 6 & 2 & 5 & 8 & & & & \end{array}$$

## Short Cuts

Rule 1. - To Multiply by 10, or any power of 10, as 100, 1000 etc, annex one cypher for each cypher in the multiplier or move the decimal point a corresponding n. of places to the right

Ex. -  $327 \times 100 = 32700$  or <sup>places</sup>

$\sqrt{4275.63} \times 1000 = 4275.630 = 4275630$

Rule 2. - To Divide by 10 or any power of 10 move the decimal point to the left as many places as there are cyphers in the Divisor

Ex  $7294 \div 1000 = 7.294$  point moved 3 pls to left.

Rule 3. - To Multiply a number made up of 2 digits by 11 when sum of the two digits is less than 10 add the 2 digits & place result between

Ex  $35 \times 11 = 385$  the 8 is sum of 3 & 5

Rule 4. To Multiply by 11 when their sum is 10 or more, add the two digits as above place right hand figure between and add the left one to the left hand figure

Ex  $78 \times 11 = 758 = 858$  the 1st 8 is  $7+1$  to carry.

Rule 5. To Multiply any number of digits by 11 put down the units figure then add the units and tens, then the tens and hundreds, the hundreds and thousands etc, carrying in each case where necessary

Ex,  $346582 \times 11 = 3812402$ . First put down 2 then  $2+8=10$  put down 0;  $8+5=13+1$  to carry = 14, put down 4 carry 1 etc.

One may also multiply by 11 by putting down 1st figure then add 1st, 2nd, then 1st 2nd & 3rd not 2nd 3rd & 4th and so on

6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
3	8	4	9	6	5	7	2	9	5	8	3	6	4	9	7	6			

# Short Cuts (continued)

Rule 6. - To Multiply by Multiples of 11 as 33, 44 etc. use just one of the two figures as a multiplier and group the figures in multiplicand as in multiplying by 11

Ex.  $\begin{array}{r} 2604580 \\ \times 55 \\ \hline 1302290 \\ 1302290 \\ \hline 14325190 \end{array}$  The small figures show the grouping and are the numbers that are multiplied by 5 for the answer

Rule 7. - To Multiply with any number from 10 to 20, multiply with the units figure only, and besides adding the carrying number, add in the figure to the right.

Ex.  $4365 \times 6$  Work. - 6 times 5 = 30, put down the 0; 6 times 6, + 3 (carrying no) + 5 = 44, put down 4; 6 times 3 + 4 + 6 = 28 put down 8; 6 times 4 + 2 = 29, put down 9 and add the carrying no; 2 and the 4 making the last figure 6.

By working this question the long way you may easily see the reason for adding the figure to the right.

One who knows the tables up to  $19 \times 9$  may not have any use for this rule.

Rule 8. - To Multiply by 21, 31 etc up to 91 use the tens figure as multiplier and add from the left, after beginning with the product of the units figures

Ex. -  $6745 \times 61$  Work. - 1st 1 times 5 = 5; then use 6 as multiplier. 6 times 5 + 4 = 34; then 6 x 4 + 3 and 7; next 6 x 7 + 3 and 6; lastly 6 x 6 + 5, making 41445.

$\begin{array}{r} 6745 \\ \times 61 \\ \hline 6745 \\ 40470 \\ \hline 411445 \end{array}$

Rule 9 - Do Multiply numbers between 10 and 20 by each other, to one of the numbers add the units of the other, annex a cypher and add the product of the units.

Ex. -  $16 \times 15$ ;  $16 + 5 = 21$ , annex a 0 = 210  
add  $6 \times 5$  or 30 = 240

Rule 10 - Do Multiply numbers of two digits each when the sum of the units makes 10, and the tens figures are alike, multiply the units for the 1st 2 figures from right and multiply the tens figure by the next higher number for remaining part of answer.

Ex. -  $63 \times 67$ ,  $3 \times 7 = 21$  at. hd. two figures  
 $6 \times 7 = 42$  rem. of answer.

answer is 4221. The last 7 is next no. above 6

2nd Ex  $96 \times 94$ ,  $6 \times 4 = 24$ ;  $9 \times 9 = 81$ ;  $\therefore 9024$  ans.

Rule 11 - Do Multiply numbers of two digits each when the sum of units makes 10 and the tens figures differ by 1, break up the two numbers so as to apply the rule - "The sum of two quantities into their difference equals the difference of their squares" Ex. -  $43 \times 37$

Break up the no's,  $43 = 40 + 3$ , and  $37 = 40 - 3$

$(40 + 3)(40 - 3) = 40^2 - 3^2 = 1600 - 9 = 1591$

2nd Ex. -  $79 \times 81 = (80 + 1)(80 - 1) = 80^2 - 1^2 = 6400 - 1 = 6399$

Special When adding long columns place a strip of paper or cardboard of some other color down by the column. This will be found of great assistance.

8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8  
5 2 3 6 7 4 2 2 7 3 6 8 4 9 7 3 5



Rule 12. To Multiply numbers of ten digits when tens figures are the same but units figures differ, multiply the units for the first figure then the sum of the units by the common tens figure, finally multiply the tens figures carrying in each case.

Ex  $\begin{array}{r} 47 \\ 42 \\ \hline 1954 \end{array}$   $2 \times 7 = 14$  carry the 1  
 $4 \times (2+7) = 36, +1 = 37$ , carry 3  
 $4 \times 4 = 16, +3 = 19$ .

Rule 13. - To Multiply when the units are alike but tens differ multiply the units for the 1st figure then the sum of the tens by the common units figure finally multiply the tens figures.

Ex  $\begin{array}{r} 54 \\ 74 \\ \hline 3996 \end{array}$   $4 \times 4 = 16$  carry 1  
 $4 \times 12(7+3) = 48, +1 = 49$  carry 4  
 $7 \times 5 = 35, +4 = 39$

Rule 14. - To Multiply when units figures are alike and tens figures add 10, multiply units figures for 1st 2 figures in answer, for remainder of answer multiply the tens figures adding in the common units figure.

Ex  $\begin{array}{r} 87 \\ 27 \\ \hline 2349 \end{array}$   $7 \times 7 = 49$  the 1st 2 figs of ans.  
 $2 \times 8 = 16 + 7 = 23$  rem of ans.

Special. To Prove Division by casting out 9's  $427/739652(1732$

Casting 9's  $\begin{array}{r} 427 \\ 3126 \\ \hline 2989 \\ 1375 \\ \hline 1281 \\ 942 \\ \hline 854 \\ 88 \end{array}$   
 out of Divisor  
 Dividend  
 Quotient & Rem -  $88 - 7$

remainder leaves the small figures shown -  $2 \times 4 + 7 = 23$  and when 9's are cast out 5 is left corresponding with the 5 from Dividend

Rule 15. To Multiply numbers under and near 100 by each other multiply the complements of the two numbers for the right hand two figures and subtract the complement of one number from the other number for the remaining figures

Ex  $97 \times 96$  - 3 is complement of 97 }  $3 \times 4 = 12$   
 $96 - 4$  " " " 96 }  
9312  $\checkmark 97 - 4$  or  $96 - 3 = 93$

Rule 16. To Multiply numbers over and near 100 by each other multiply the supplements for the right hand two figures and add the supplement of one number to the other number for remaining figures

Ex  $109 \times 119$  - 9 is supplement }  $9 \times 9 = 81$   
 $109 - 9$  " " "  
11237  $\checkmark 109 + 9$  or  $119 + 9 = 112$

Rule 17. To Multiply numbers over 100 by numbers under 100 multiply the number under 100 by the units figure in the number for right hand two figures; then carry the 3rd figure in that product to the number under 100 to make rem. of one.

Ex  $106 \times 84$  6 times 84 = 504, put down  
84 04 and add the 5 to 84  
8904 making 89 the last 2 figures.

9999999999999999  
57394863925693826

Cross Multiplication  
Two figures by two, - three by two, - and three by three.

Two Figures by Two Figures  
Rule 18. - Multiply units by units then cross multiply tens by units and finally tens by tens adding in the carrying numbers  
Ex. -  $\begin{array}{r} 34 \\ 56 \\ \hline \end{array}$   $\begin{array}{r} 34 \\ 88 \\ \hline \end{array}$   $\begin{array}{r} 34 \\ 1904 \\ \hline \end{array}$   $\begin{array}{r} 34 \\ 2368 \\ \hline \end{array}$

Three Figures by Two  
Rule 19. - Multiply units by units, then cross multiply tens by units, next hundreds by units and tens by tens and finally, hundreds by tens adding carrying no.  
Ex.  $\begin{array}{r} 623 \\ 45 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 33 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 48 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 825 \\ \hline \end{array}$

Three Figures by Three  
Rule 20. - Multiply units by units, then cross multiply tens by units, next cross multiply units by hundreds and tens by tens next tens by hundreds and finally hundreds by hundreds  
Ex  $\begin{array}{r} 623 \\ 473 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 25 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 623 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 5623 \\ \hline \end{array}$   $\begin{array}{r} 623 \\ 295623 \\ \hline \end{array}$

2 2 2 3 3 3 3 4 4 4 4 5 5 5 5 5 5  
7 4 3 8 6 9 5 7 2 8 5 9 6 7 3 8 4

Rule 21. - To Multiply by numbers near and under 100, find the difference between the number and 100 and take this difference times the number away from 100 times the number. Ex  $4356 \times 98$ ;  $(100-98=2)$   
 $435600$  is 100 times the number.

$$\begin{array}{r} 8712 \\ 426885 \\ \hline \end{array} \quad \begin{array}{r} 2 \\ 98 \\ \hline \end{array}$$

Rule 22. - To Multiply by numbers near and over 100, find the difference as above and to 100 times the number add this difference times the number. Ex  $7564 \times 106$ .  $(106-100=6)$   
 $756400$  is 100 times the number

$$\begin{array}{r} 45384 \\ 45384 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ 106 \\ \hline \end{array}$$

Rule 23. - To Multiply by numbers under or over 1000 proceed as in last two rules using 1000 as multiplier instead of 100

Rule 24. - When the numbers will admit of it, multiply one and divide the other by the same number to make the work of multiplying more simple

Ex  $45$

by  $28$  double  $40$  and half  $28$ .

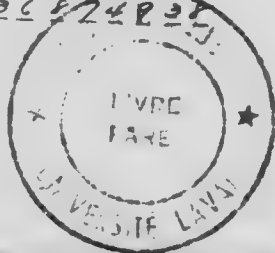
$90 \times 14$ , double and half again =

$180 \times 7 = 1260$  The special advantage in this rule is in doing mental work!

2nd Ex  $53 \times 18 = 106 \times 9 = 954$

or  $35 \times 14 = 70 \times 7 = 490$

6 6 6 6 7 7 7 7 6 6 6 6 7 7 7 7 6 6 6 6 6  
 3 4 2 8 6 7 4 4 3 8 4 6 5 9 3 6 8 2 4 8 3 5



Rule 25 - When one part of a multiplier is a factor of another part the following method may be used

1st Ex - 4576

$$\begin{array}{r} 549 \\ \hline 41184 \\ 247104 \\ \hline 2512224 \end{array}$$

9 is a factor of 54.

$$= 9 \times 4576$$

$$= 6 \times 41184 \text{ or } 54 \times 4576$$

$$= 549 \times 4576$$

2nd Ex 3725

$$\begin{array}{r} 648 \\ \hline 22350 \\ 178800 \\ \hline 2413800 \end{array}$$

6 is a factor of 48.

$$= 6 \times 3725 \text{ (begin under 6)}$$

$$= 8 \times 22350 \text{ or } 48 \times 3725$$

$$= 648 \text{ times } 3725$$

Always begin the partial product under the right hand figure of the multiplier.

In the last ex. we might have taken 8 as a factor of 48.

Rule 26 - To Square any number under 100 add such a number as will make an easy multiplier subtract the same number for the other factor and to the product of these two numbers add the square of the number you added and subtracted.

$$1st \text{ Ex } 97^2 = 100 \times 94 + 3^2 = 9400 + 9 = 9409$$

We added 3 to 97 to get 100; subtracted 3 to get 94;

$$2nd \text{ Ex } 36^2 = 40 \times 32 + 4^2 = 1280 + 16 = 1296$$

$$3rd \text{ " } 49^2 = 50 \times 48 + 1^2 = 2400 + 1 = 2401$$

Note - The small figure <sup>2</sup> placed above and to the right of any number means the number is to be squared Ex -  $9^2 = 9 \times 9$ .

$$\begin{array}{r} 8888889999999988888 \\ 5976438639472638479 \end{array}$$

Squaring Numbers Ending in 5, 25 & 75.

Rule 27. To square numbers ending in 5; square the 5 for the right hand two figures and multiply the tens figure by the next number higher for the balance of the answer.

Ex  $35^2 = 1225$  The 25 is  $5^2$  and 12 is  $3 \times 4$

$85^2 = 7225$  " 25 "  $5^2$  72 "  $8 \times 9$

Rule 28 To Square Numbers ending in 25; as  $825^2$ , the three figures to the right will always be the square of 25, or 625. The fourth figure will be 0 or 5; 5 if 3rd figure in question is odd. The remaining two figures is the square of the 3rd figure plus half the 3rd figure.

Ex  $825^2 = 680625$ . The 625 is square of 25

The 68 is  $8 \times 8 + \frac{1}{2}$  of 8.

$925^2 = 855625$ . The 855 is  $9 \times 9 + \frac{1}{2}$  of 9.

Rule 29 To Square Numbers ending in 75 as  $875^2$ ; the four figures to the right will be 5625 (the square of 75) unless the 3rd figure in the question is odd when the 4th figure - 5 - will change to 0; the remaining two figures is the product of the 3rd figure and the next higher in order plus half the 3rd figure.

Ex  $875^2 = 765625$  The 5625 is square of 75

The 76 =  $8 \times 9 + \frac{1}{2}$  of 8.

$975^2 = 950625$  The 950 =  $9 \times 10 + \frac{1}{2}$  of 9 =  $94\frac{1}{2}$

This  $94\frac{1}{2}$  or  $94\frac{1}{2}$  becomes 950

when the 4th figure in the square of 75 viz 5 is added to the 5 which the  $\frac{1}{2}$  with 94 equals

2 3 4 5 6 7 8 9 2 3 4 5 6 7 8 9  
4 7 5 3 1 3 5 7 9 9 7 5 3 1 5 3

### Aliquot Parts

This heading refers to short cuts for multiplying or dividing by even parts of 10, 100 or 1000 as 3's, 16's or 125's

Rule 30 - To Multiply by 2's ( $\frac{1}{2}$  of 10) divide by 2 and consider result as tens.

Ex.  $24 \times 2\frac{1}{2} = 24 \div 2 = 6 \text{ tens} = 60$

Rule 31 - To Multiply by 25's ( $\frac{1}{4}$  of 100) divide by 4 and consider result as hundreds.

Ex.  $254 \times 25 = 254 \div 4 = 63\frac{1}{2} \text{ hundreds} = 6350$

Rule 32 - To Multiply by 250's ( $\frac{1}{4}$  of 1000) divide by 4 and consider the result as thousands

Ex.  $512 \times 250 = 512 \div 4 = 128 \text{ thousands} = 128,000$

Rule 33 - To Multiply by 125's ( $\frac{1}{8}$  of 1000) or ( $\frac{1}{8}$  of 1000) to the number add  $\frac{1}{2}$  of the number and consider the ans. as 100's; or divide the number by 8 and consider the answer as 1,000's

Ex.  $64 \times 125 = 64 + \frac{1}{2} \text{ of } 64 = 80 \text{ hundreds} = 8,000$

or  $64 \times 125 = 64 \div 8 = 8 \text{ thousands} = 8,000$

or  $252 \times 125 = 252 \div 8 = 31\frac{1}{2} = 31,500$

Note To Divide by Aliquot Parts do the exact opposite to that done when multiplying by the same aliquot part

Ex.  $4250 \div 25 = 4250 \times 4 \text{ and } \div 100 = 170.00$

See Rule 2 for dividing by 100

Ex.  $1592 \div 250$  Multiply 1592 by 4 and mark off 3 places;  $1592 \times 4 = 6368$

12	18	13	16	14	19	16	15	18	11	18	16	14
<u>4</u>	<u>5</u>	<u>9</u>	<u>6</u>	<u>8</u>	<u>3</u>	<u>7</u>	<u>5</u>	<u>9</u>	<u>8</u>	<u>6</u>	<u>3</u>	<u>6</u>

Rule 34. To Multiply by  $3\frac{1}{3}$  ( $\frac{1}{3}$  of 10) divide by 3 and consider the answer as tens.

Ex.  $45 \times 3\frac{1}{3} = 45 \div 3 = 15 \text{ tens} = 150$

Rule 35. To Multiply by  $33\frac{1}{3}$  ( $\frac{1}{3}$  of 100) divide by 3 and consider the ans. as hundreds.

Ex.  $147 \times 33\frac{1}{3} = 147 \div 3 = 49 \text{ hundreds} = 4900$

Rule 36. To Multiply by  $333\frac{1}{3}$  ( $\frac{1}{3}$  of 1000) divide by 3 and consider the ans. as thousands.

Ex.  $982 \times 333\frac{1}{3} = 982 \div 3 = 327\frac{2}{3} \text{ thousands} = 327333\frac{2}{3}$

Rule 37. To Multiply by  $66\frac{2}{3}$  ( $2 \times 33\frac{1}{3}$ ) proceed as in Rule 35 and multiply by 2

Ex.  $58 \times 66\frac{2}{3} = 58 \div 3 = 19\frac{2}{3} \times 2 = 38\frac{4}{3} \text{ hundreds} = 3866\frac{2}{3}$

Rule 38. To Multiply by  $666\frac{2}{3}$  ( $2 \times 333\frac{1}{3}$ ) proceed as in Rule 36 and multiply by 2

Ex.  $765 \times 666\frac{2}{3} = 765 \div 3 = 255 \times 2 = 510 \text{ thousands} = 510000$

Rule 39. To Multiply by  $13\frac{1}{3}$  ( $10 + \frac{1}{3}$  of 10), to the number add  $\frac{1}{3}$  the number and consider the answer as tens

Ex.  $72 \times 13\frac{1}{3} = 72 + \frac{1}{3} \text{ of } 72 = 96 \text{ tens} = 960$

Rule 40. To Multiply by  $133\frac{1}{3}$  ( $100 + \frac{1}{3}$  of 100), to the number add  $\frac{1}{3}$  the number and consider the answer as hundreds.

Ex.  $427 \times 133\frac{1}{3} = 427 + \frac{1}{3} \text{ of } 427 = 569\frac{1}{3} \text{ hundreds} = 56933\frac{1}{3}$

23 25 21 27 22 29 24 28 26 23 27  
9 6 8 9 5 8 9 8 6 8 7



Rule 41. To Multiply by 5 ( $\frac{1}{2}$  of 10) divide by 2 and consider the answer as  $10^{\text{th}}$  (tens)

Ex.  $346 \times 5 = 346 \div 2$  or 173 tens = 1730

Rule 42. To Multiply by 50 ( $\frac{1}{2}$  of 100) divide by 2 and consider result as  $100^{\text{th}}$

Ex.  $392 \times 50 = 392 \div 2$  or 196 hundreds = 19,600.

Rule 43. To Multiply by 500 ( $\frac{1}{2}$  of 1000) divide by 2 and consider result as thousands.

Ex.  $495 \times 500 = 495 \div 2 = 247\frac{1}{2}$  thousands = 247,500.

Rule 44. To Multiply by 15 ( $10 + \frac{1}{2}$  of 10) to the number add  $\frac{1}{2}$  the number and consider the ans. as  $10^{\text{th}}$

Ex.  $84 \times 15 = 84 + \frac{1}{2} \text{ of } 84 = 126^{\text{ans}} = 1260$

Rule 45. To Multiply by 150 ( $100 + \frac{1}{2}$  of 100) to the number add  $\frac{1}{2}$  the number and consider the result as  $100^{\text{th}}$

Ex.  $476 \times 150 = 476 + \frac{1}{2} \text{ of } 476 = 714^{\text{hundreds}} = 71,400$

Special: To Find the correct remainder when dividing by factors

Ex.  $423767 - 8$  using factors 3, 4 & 7

$$\begin{array}{r} 3 \overline{) 423767} \\ 4 \overline{) 423767} \\ 7 \overline{) 423767} \end{array}$$

$$\begin{array}{r} 4 \overline{) 423767} \\ 7 \overline{) 423767} \end{array}$$

$$\begin{array}{r} 7 \overline{) 423767} \\ 3 \overline{) 423767} \end{array}$$

$$\begin{array}{r} 3 \overline{) 423767} \\ 4 \overline{) 423767} \\ 7 \overline{) 423767} \end{array}$$

Multiply last remainder by 2nd last divisor.

add 2nd last remainder

multiply by 1st divisor and add in first

remainder as follows  $(5 \times 4 + 3) \times 3 + 2 = 71^{\text{rem}}$

To Divide two Numbers when one or both are in a fraction get rid of the fractions by multiplying through by the LCM of the denominators

$$\begin{array}{r} 17\frac{1}{2} \overline{) 7413\frac{1}{2}} \\ 315 \overline{) 22245} \end{array}$$

Here 30 is LCM of 6 & 3  
divide for ans; divide rem. by 30.

$$\begin{array}{cccccccccccccccc} 31 & 37 & 34 & 39 & 36 & 38 & 34 & 37 & 35 & 38 & 31 \\ 9 & 11 & 8 & 11 & 13 & 12 & 9 & 12 & 15 & 13 & 11 \end{array}$$

Rule 46. To Multiply by  $12\frac{1}{2}\%$  ( $\frac{1}{8}$  of 100) divide by 8 and consider result as 100%.

Ex.  $432 \times 12\frac{1}{2}\% = 432 \div 8 = 54$  hundred = 5400.

Rule 47. To Multiply by  $37\frac{1}{2}\%$  ( $\frac{3}{8}$  of 100) divide by 8 and multiply by 3 and consider result as 100%.

Ex.  $96 \times 37\frac{1}{2}\% = 96 \div 8 \times 3 = 36$  hundred = 3600.

$74 \times 37\frac{1}{2}\% = 74 \div 8 \times 3 = 29\frac{1}{2}\% = 2962\frac{1}{2}$

Rule 48. To Multiply by  $62\frac{1}{2}\%$  ( $\frac{5}{8}$  of 100) divide by 8, multiply by 5, consider result as 100%.

Ex.  $92 \times 62\frac{1}{2}\% = 92 \div 8 \times 5 = 57\frac{1}{2}\%$  hundred = 5750.

Rule 49. To Multiply by  $87\frac{1}{2}\%$  ( $\frac{7}{8}$  of 100) divide by 8, multiply by 7, consider result as 100%.

Ex.  $65 \times 87\frac{1}{2}\% = 65 \div 8 \times 7 = 56\frac{1}{4}\%$  hundred = 5687 $\frac{1}{2}$ .

Rule 50. To Multiply by  $112\frac{1}{2}\%$  ( $\frac{9}{8}$  of 100) to the number add  $\frac{1}{8}$  the number and consider result as 100%.

Ex.  $56 \times 112\frac{1}{2}\% = 56 + \frac{1}{8} \text{ of } 56 = 63$  hundred = 6300.

"  $142 \times 112\frac{1}{2}\% = 142 + \frac{1}{8} \text{ of } 142 = 159\frac{1}{4}\%$  hundred = 15975.

Note. Learn to count by  $12\frac{1}{2}\%$  to 100 -  $12\frac{1}{2}, 25, 37\frac{1}{2}, 50, 62\frac{1}{2}, 75, 87\frac{1}{2}, 100$  Know at a glance that  $\frac{3}{8} = 37\frac{1}{2}\%$ ;  $\frac{5}{8} = 62\frac{1}{2}\%$  and  $\frac{7}{8} = 87\frac{1}{2}\%$

45	42	47	46	44	48	43	49	47	46
<u>12</u>	<u>17</u>	<u>11</u>	<u>13</u>	<u>10</u>	<u>13</u>	<u>14</u>	<u>11</u>	<u>15</u>	<u>18</u>

Rule 51 To Multiply by  $16\frac{2}{3}$  ( $\frac{1}{6}$  of 100) divide by 6 and consider result as 100's.

Ex.  $576 \times 16\frac{2}{3} = 576 \div 6$  or 96 hundreds = 9600.

Rule 52 To Multiply by  $83\frac{1}{3}$  ( $\frac{1}{3}$  of 100) divide by 6, multiply by 5 and consider result as 100's.

Ex.  $495 \times 83\frac{1}{3} = 495 \div 6$  or  $82\frac{1}{2} \times 5 = 412\frac{1}{2}$  hundreds = 41250.

Rule 53 To Multiply by  $116\frac{2}{3}$  ( $\frac{2}{3}$  of 100) to the number add  $\frac{1}{3}$  the number and ans. '1 in 100's.

Ex.  $486 \times 116\frac{2}{3} = 486 + \frac{1}{3}$  of 486 = 486 + 162 = 648 hundreds = 64800.

"  $245 \times 116\frac{2}{3} = 245 + \frac{1}{3}$  of 245 = 245 + 81 = 326 hundreds = 32600.

Note Learn to count by  $16\frac{2}{3}$  to 100 -  $16\frac{2}{3}$ ,  $33\frac{1}{3}$ , 50,  $66\frac{2}{3}$ ,  $83\frac{1}{3}$ , 100. Notice  $\frac{2}{3} = 83\frac{1}{3}$ .

### Other Aliquot Parts

$6\frac{1}{2}$  is  $\frac{1}{2}$  of 100 - divide by 16, consider ans. as 100's.  
 $8\frac{1}{3}$  "  $\frac{1}{3}$  " 100 - " " 12, " " " "  
 $9\frac{1}{11}$  "  $\frac{1}{11}$  " 100 - " " 11, " " " "  
 $11\frac{1}{9}$  "  $\frac{1}{9}$  " 100 - " " 9, " " " "  
 $12\frac{1}{2}$  "  $\frac{1}{2}$  " 100 - " " 7, " " " "

Others might be added but as they are seldom used in business they are not emphasized.

57	54	56	59	51	58	52	56	51	59
<u>11</u>	<u>15</u>	<u>10</u>	<u>14</u>	<u>19</u>	<u>16</u>	<u>18</u>	<u>12</u>	<u>16</u>	<u>12</u>

Rule 54 To Square numbers ending in  $\frac{1}{2}$  square the  $\frac{1}{2}$  for fraction in ans. multiply the whole number by the next higher in order.

Ex  $8\frac{1}{2}^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  or  $\frac{1}{4}$  and  $8 \times 9 = 72$  ans =  $72\frac{1}{4}$

"  $14\frac{1}{2}^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  or  $\frac{1}{4}$  and  $14 \times 15 = 210$  " =  $210\frac{1}{4}$

Rule 55 To Multiply numbers ending in  $\frac{1}{2}$  square the  $\frac{1}{2}$ ; then to the product of the two numbers add half their sum

Ex  $9\frac{1}{2} \times 6\frac{1}{2} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  or  $\frac{1}{4}$  and  $9 \times 6 = \frac{1}{2}$  of  $(9+6) = 61\frac{1}{2} + \frac{1}{4} = 61\frac{3}{4}$

"  $14\frac{1}{2} \times 8\frac{1}{2} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  or  $\frac{1}{4}$  and  $14 \times 8 = \frac{1}{2}$  of  $(14+8) = 113 + \frac{1}{4} = 113\frac{1}{4}$

Rule 56 To Square a number ending in  $\frac{1}{2}$  square the  $\frac{1}{2}$  and to this add the square of the whole number plus half the number.

Ex.  $12\frac{1}{2}^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  and  $12^2 + \frac{1}{2}$  of  $12 = 150 + \frac{1}{4} = 150\frac{1}{4}$ .

"  $15\frac{1}{2}^2 = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$  and  $15^2 + \frac{1}{2}$  of  $15 = 232\frac{1}{2} + \frac{1}{4} = 232\frac{3}{4}$ .

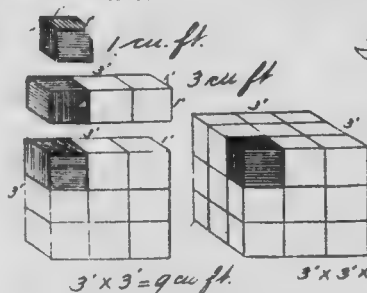
Rule 57 To Multiply numbers ending in fractions first multiply the fractions, then cross multiply fractions and whole numbers and finally multiply whole nos. and add.

Ex.  $36\frac{1}{2}$

$$\begin{array}{r} 48\frac{1}{2} \\ \times 36\frac{1}{2} \\ \hline \frac{1}{2} = \frac{1}{4} \times \frac{1}{2} \\ 9 = \frac{1}{2} \times 36 \\ 16 = \frac{1}{2} \times 48 \\ 1728 = 48 \times 36 \\ \hline 1753\frac{1}{2} \end{array}$$

Ex.  $242\frac{1}{2}$

$$\begin{array}{r} 46\frac{1}{2} \\ \times 242\frac{1}{2} \\ \hline \frac{1}{2} = \frac{1}{4} \times \frac{1}{2} \\ 60\frac{1}{2} = \frac{1}{2} \times 242 \\ 15\frac{1}{2} = \frac{1}{2} \times 46 \\ 11132 = 46 \times 242 \text{ by cross } \times \\ \hline 11207\frac{1}{2} \end{array}$$



These Figures may aid understanding Cubical Contents 1 cu. ft. is the unit of measurement here. A Cube.

61	63	69	62	68	64	67	69	63	65	68
17	11	14	18	16	13	19	11	16	15	18

Rule 58. To Add two simple fractions, whose numerators are 1, add the denominators for a new numerator and multiply them for a new denominator

Ex.  $\frac{1}{4} + \frac{1}{5} = \frac{4+5}{4 \times 5} = \frac{9}{20}$  ans

Rule 59. To Subtract simple fractions when the numerator is 1 subtract the denominators for a new numerator and multiply them for a new denominator.

Ex.  $\frac{1}{3} - \frac{1}{4} = \frac{4-3}{4 \times 3} = \frac{1}{12}$  ans

Rule 60. To Add any two simple fractions cross multiply and add for the numerator and multiply denominators for the denominator

Ex.  $\frac{3}{4} + \frac{4}{9} = \frac{(4 \times 4) + (3 \times 9)}{4 \times 9} = \frac{43}{36} = 1\frac{7}{36}$

Special.

(1) To Divide by a number ending in cyphers, mark off the last two figures in the dividend (or as many figures as there are cyphers) and divide by that then attach the cancelled figures to the remainder for the correct remainder

Ex.  $606 \overline{) 497120}$   
 $\underline{1212} \quad 162$

(2) To Find a Single Discount equal to 2 or more successive Discounts

Ex.  $30\% \quad 20\% \quad \& \quad 10\% = ?$

$30 + 20 - \frac{(30 \times 20)}{100} = 44$  this equals  $30\% \& 20\%$  off.  
 $44 + 10 - \frac{(44 \times 10)}{100} = 44.6$        $40\% \& 10\%$  off.  
 So  $30\% \quad 20\% \quad \& \quad 10\%$  off =  $44.6$  or  $44\frac{3}{5}\%$  off.

70	74	76	78	79	78	76	74	72	70
18	13	14	14	15	16	18	13	11	14

# Simplified Interest

Rule 61. To Find Accurate Interest  
 multiply  $\frac{\text{Sum in dollars} \times \text{Time in years} \times \text{Rate per cent}}{365}$

Ex. Find Simp. Int. on \$20 for 90 days at 5%  
 $200 \times \frac{90}{365} \times 5 = \frac{9000}{73} = 123.28767123 \approx \$12.33$

Note. This method is used by the Government of Canada and of United States, by the merchants & Banks of Canada and by a few of the American Banks

Rule 62. To Find Ordinary Int. proceed as above using 360 days to the year; or take as a basis the interest for 60 days at 6% which always equals the sum given with the decimal point moved 2 places to the left

Ex. Find Int. on \$200 for 90 days at 6%

\$200 is Int. for 60 days at 6%  
 270 " " " 30 " " 6%  
 27 " " " 3 " " 6%  
 837 " " " 93 " " 6%

If Rate is 5% use 6% & deduct 1/10%  
 " 7% " " " add 1/10% etc

To change Ordinary to Accurate Interest deduct 1/3%

Legal Rate. - In Canada 5%; In Border States 6%, excepting Michigan 5%; Nth Dak & Idaho 7%; Mont 5%, Wash 10%.

Abundant practice should be given in finding time between two dates as from Mar 17 to July 25; or June 11 to Dec 1 (Do not count Mar 17 but count July 20.)

80 84 86 85 89 86 83 85 87 89 83  
 19 16 13 13 16 12 14 11 17 16 12

Simple Interest (continued)

The Ordinary Interest on

\$720	for 360 days (1 yr)	@ 1%	= 7.20
720	" 180 "	" 2%	= 7.20
720	" 120 "	" 3%	= 7.20
720	" 90 "	" 4%	= 7.20
720	" 72 "	" 5%	= 7.20
720	" 60 "	" 6%	= 7.20
720	" 45 "	" 8%	= 7.20
720	" 30 "	" 9%	= 7.20

The Interest in each case above is 1% or  $\frac{1}{10}$  of the principal, — why? 60 days at 6% however, is more commonly used as a base and gives reason for same "6% Method". The few questions in the Pad are not sufficient drill in "6% Method".

Percentage

In finding percentage of numbers one should use the shortest method possible.

Ex: 10% =  $\frac{1}{10}$ , and  $\frac{1}{10}$  moves decimal point one place to left, as 10% (or  $\frac{1}{10}$ ) of 365 = 36.5

Ex: 1% =  $\frac{1}{100}$ , and moves the point 2 places to left.

1% of \$3260 = \$32.60, 10% of \$3260 = \$326

to find 2% first find 1% then multiply by 2.

3%, 4%, 6%, 7%, 8% or 9% do same.

And to find 20% find 10% and multiply by 2

30% etc do the same

Then .. 33% take  $\frac{1}{3}$  of 10%,  $2\frac{1}{2}\%$  =  $\frac{1}{4}$  of 10%

15% = 10% + ( $\frac{1}{2}$  of 10%); 50% =  $\frac{1}{2}$  the number; 33% =  $\frac{1}{3}$  the number, 25% =  $\frac{1}{4}$ ,  $16\frac{2}{3}\%$  =  $\frac{1}{6}$ , etc.

To Change Fractions to Percentage Multiply by 100

" " Percentage Fractions Divide " 100

90	95	94	99	98	96	93	94	97	92	98
17	23	19	22	18	31	17	36	42	28	16

## Measurements

Rule 63 To Find the number of board feet in Lumber, multiply length in ft by width in ft by thickness in inches. Less than 1" is counted one inch.

Ex. A plank 14' long by 9" wide by 2" thick  
 $= 14 \times \frac{9}{12} \times 2 = 21$  feet board measure

Rule 64 To find cost of lumber when number of feet are given, multiply the number of feet by the price in \$ per 1000 and mark off 3 places.

Ex. 4280' @ \$22 per M. = \$941.60 = \$941.60

Rule 65 To find the board feet in a log at least 6" in diameter at small end, from the mean diameter in inches subtract 4" for slabs; square  $\frac{1}{2}$  of remainder and multiply the product by the length in ft.

Ex. Log is 32' at small end 40' at large end and is 18" long. —,  $(32 + 40) \div 2 = 36$ " mean dia  
 $36 - 4$  (for slabs) = 32;  $32 \div 4 = 8$ ; and  $8^2 \times 18 = 1152$  ft.  
(Doyle's Rule.)

Rule 66 To Find the Number of cu. ft. in Round Timber multiply the square of the circumference at the middle of log, in feet, by 8 times the length and point off 2 places.

Ex. Log at middle is 6' in circumference & 20' long  
 $6^2 = 36$ ;  $36 \times 8 \times 20 = 5760$  <sup>in ft.</sup> = 57.60 = 57.60 <sup>in ft.</sup>

Rule 67 To Find the number of Yards of Hay in a Stack divide the number of cubic feet by 300.

Ex. - Stack contains 28000 <sup>cu ft.</sup>;  $28000 \div 300 = 93\frac{1}{3}$ .

Note - To find cu. ft. in stack, look up Measurement.

34	69	72	48	69	84	75	86	92	68
71	36	44	73	94	28	36	48	39	72



Rule 68 To Find Number of yds. of cloth in a bolt to the number of inches around the bolt add the number of inches across the board; divide this by 2 and multiply by the number of folds in the bolt; thus divided by 36 gives no. of yds.

Ex - Bolt 25" in  $\circ^w$ , 10" across and 18 folds.

$$(25 + 10) \div 2 \times 18 = 360 \div 36 = \underline{10 \text{ yds.}}$$

Rule 69 To Find Cost of Coal, Hay, Straw or Bricks when sold by the ton (2000<sup>lbs</sup>) multiply the number of lbs. by half the price in dollars and point off 3 places. If advisable divide the number of lbs. by 2 instead of the price.

Ex. 42560 lbs coal @ \$4 per ton

$$= 42560 \times 4 (\text{which is } \frac{1}{2} \text{ of } 8) = 170240 = \underline{\$170.240}$$

Ex. 9560 lbs hay @ \$9 per ton

$$\frac{1}{2} \text{ of } 9560 \text{ or } 4780, \times 9 = 43020 = \underline{\$43.020}$$

Rule 70 - To Add Consecutive Numbers beginning with 1 multiply the sum of the 1st and last number by half the larger number

Ex. Add numbers from 1 to 50

$$= (1 + 50) \times (\frac{1}{2} \text{ of } 50) = 51 \times 25 = 1275$$

Ex - Add numbers from 12 to 20

$$\text{1st add numbers 1 to 20} = 21 \times 10 = 210$$

$$\text{Then } \dots \dots \dots 12 = 13 \times 6 = \underline{78}$$

$$\text{and take the difference} = \underline{132}$$

Rule 71 To Find the Number of Bushels of Oats in any number of 100<sup>lbs</sup> of lbs multiply the number of 100<sup>lbs</sup> by 3 for bushels and by 2 for the number of lbs lacking. Ex 800<sup>lbs</sup> = 8 x 3 or 24 bus all but 2 x 2 or 16 lbs. This is because 100 lbs = 3 bus - 2 lbs; Ex 1200<sup>lbs</sup> = 36 bus - 24 lbs

Rule 72 To Find bus. of Barley in 100<sup>lbs</sup> of lbs, because 100<sup>lbs</sup> barley = 2 bus + 4 lbs, multiply number of 100<sup>lbs</sup> by 2 for bus & 4 for lbs. Ex 700<sup>lbs</sup> = 7 x 2 or 14 bus and 7 x 4 = 28 lbs; 1100<sup>lbs</sup> Barley = 22 bus and 40 lbs.

Measurements Master

## More Measures to Master

There are! -

- 28 Days in February (in Leap Year 29)  
 30 " " April, September, June & November.  
 31 " " 7 Remaining Months
- 1 £ Sterling =  $\$4.86\frac{2}{3}$  ; 1 Crown =  $\$2.2\frac{1}{2}$   
 1 Guinea = 21 Shillings =  $\$5.25$   
 1 Franc (Fr. & Belg.) & 1 Lira (Italy) = 19.3 "  
 1 Mark (Germany) = 29.8 "  
 1 Yen (Japan) = 88.8 "

### Exchange.

Old Par 1 £ =  $\$4.8\frac{1}{2}$  ; New Par is  $9\frac{1}{2}\%$  above Old Par, =  $\$4.86\frac{2}{3}$   
 Sterling Exchange is usually quoted at a per-  
 cent (near  $9\frac{1}{2}\%$ ) above the old par; occasionally  
 near the new par in  $\$^s$  &  $\phi^s$

Exchange on France may be quoted as so many  
 cents per franc or so many francs per dollar

1 board foot = 1 foot long 1 foot wide & 1" thick

1 cu ft water =  $7\frac{1}{2}$  Imp. gals and weighs  $62\frac{1}{2}$  lbs (1000 gr).

1 gal. (Imperial) = 277.275  $\text{cu in}$  and weighs 10 lbs

1 " (U.S. Standard) = 231  $\text{cu in}$  " " 8  $\frac{1}{2}$  "

1 bus. (Imperial) = 2218.92  $\text{cu in}$  = 50 lbs

1 " (U.S. Standard) = 2150.42 " " = 77  $\frac{1}{2}$  "

1 cu ft = about  $\frac{1}{4}$  of a Standard Bushel

1 bbl. apples = 135 lbs

1 " flour = 196 "

1 " pork = 200 "

1 " sugar = 200 "

1 " lime = 240 "

1 " salt = 280 "

One Horsepower is  
 equivalent to raising  
 33,000 lbs 1 foot per  
 minute

## Mensuration

The Simple Rules only are given here.

Perimeter of a plane figure is the distance around it i.e.  $(\text{length} + \text{width}) \times 2$

Circumference is perimeter of a circle.

Diameter is a straight line through the centre of a circle and ending at  $\circ^{\text{ce}}$ .

Radius is half the diameter.

$$\text{Circumference} = \text{Diameter} \times 3\frac{1}{2}$$

Area of -

A Rectangle = Length  $\times$  Width

A Circle =  $r^2 \times 3\frac{1}{2}$  (or  $\pi$ ) =  $\pi r^2$


A Sphere =  $\text{Dia}^2 \times 3\frac{1}{2}$  =  $\pi d^2$

A Cylinder =  $\circ^{\text{ce}}$  of Base  $\times$  Height + Area both ends

A Right Angle Triangle =  $\frac{1}{2}$  Product of 2 sides on  $\text{rt.}^{\text{le}}$ .

Any Triangle - the 3 sides being given =


From half the sum of the 3 sides subtract each side; find product of the half of sum & the 3 remainders and extract the square root.

Ex   $\frac{1}{2}$  of  $(13 + 14 + 15) = 21$

$21 - 13 = 8$ ;  $21 - 14 = 7$ ;  $21 - 15 = 6$

Now multiply  $21 \times 8 \times 7 \times 6 = 7056$

Square Root of  $7056 = 84 \text{ sq ft.}$

A Triangle when base & altitude are given  multiply base by half the altitude =  $20 \times 8 = 80$

Cubical Contents of

A Rectangular Solid = Length  $\times$  Width  $\times$  Height

A Cylinder - Area of Base  $\times$  Height of Cylinder

A Sphere =  $\text{Dia}^3 \times 3\frac{1}{2} \div 6$  =  $\frac{\pi d^3}{6}$

## Exchange

Canada and United States money is practically the same. Exchange with the Old Countries, however, presents some difficulties.

When at par £1. Sterling = \$4.86 $\frac{2}{3}$ ; this is 9 $\frac{1}{2}$ % above old par (\$4.44 $\frac{4}{5}$ ) and is sometimes thus quoted.

When at par any one of 3 methods may be used, as shown herewith

Find cost of a Bill of Exchange on London for —  
£40-10-0. This equals £40 $\frac{2}{5}$  or £40.525

1st Taking £1 = \$4.86 $\frac{2}{3}$

$$240.525 \times 4.86\frac{2}{3} = \underline{\$1170.56}$$

2nd Taking £1 = 9 $\frac{1}{2}$ % above old par

$$240.525 \times 4\frac{4}{9} \times 1.09\frac{1}{2} = \underline{\$1170.57}$$

3rd Taking £1 = \$4.00 + \$.80 + \$.06 $\frac{2}{3}$

Notice that 80¢ is  $\frac{1}{5}$  of \$4.00 and 6 $\frac{2}{3}$ ¢ is  $\frac{1}{2}$  of 80¢

$$240.525 =$$

4.	
5) 962.100	= 4.00 times 240.525
12) 192.420	= .80 " "
16.035	= .06 $\frac{2}{3}$ " "
1170.555	= 4.86 $\frac{2}{3}$

The 3rd method is largely used by Governments

The 2nd method is mostly used in Business, as exchange is usually a little above or below par. Example of 2nd method follows. —

Find the cost of a Bill of Exchange on Glasgow for £160-10-0, exch. at 8 $\frac{1}{2}$ ¢.

$$\text{Work. — } £160-10-0 = £160\frac{1}{2}$$

$$160\frac{1}{2} \times 4\frac{4}{9} \times 1.08\frac{1}{2}$$

$$= 160.5 \times \frac{40}{9} \times 1.085 = \underline{\$773.97}$$

$$\text{or } \frac{321}{2} \times \frac{40}{9} \times \frac{217}{200} = \underline{\$773.97}$$

Note — Memorize the Exchange on different countries, given on p 34.

## Metric System of Measurements

There are 3 units of measurements.

Metre. Litre. Gram.

Metre = 39.37"; Litre = 1.05678<sup>qt.</sup>; Gram = 15.432<sup>grs.</sup>

Metre - One ten-millionth part of distance from the Equator to the Pole

Metric System increases and decreases by the decimal scale (decum means ten).

### Metric Linear Measure

1 Millimetre	= $\frac{1}{1000}$ Metres
1 Centimetre	= $\frac{1}{100}$ "
1 Decimetre	= $\frac{1}{10}$ "
1 Metre	= 1 "
1 Dekametre	= 10 "
1 Hektometre	= 100 "
1 Kilometre	= 1000 "
1 Myriametre	= 10000 "

### Metric Measure of Capacity

If in the above table you change "metre" to "litre" throughout you have the measure of capacity.

### Metric Measure of Weight

1 Decigram	= $\frac{1}{10}$ Gram
1 Gram	= 1 "
1 Dekagram	= 10 "
1 Hectogram	= 100 "
1 Kilogram	= 1000 "
1 Myriagram	= 10000 "
1 Quintal	= 100000 "
10 Quintals	= 1 Ton

### Table of Equivalents

1 in. = 2.54 centimeters	1 centimeter = .3937"
1 ft. = 30.48 centimeters	1 decimeter = .328'
1 yd. = 91.44 " "	1 meter = 1.0936 yds
1 rd. = 5.029 metres	1 dekameter = 1.0936 rds
1 ml. = 1.6093 kilometres	1 kilometer = 6.2137 of a ml.

## Discour. ts

Ba      True      Trade      Cash or Merc.

Ba      Discount.

Ex. - A Note for \$300 dated Jan 1 - is at 30 days is discounted immediately at 6%.

Work:  $300 \times 33 \times 6 = \$6.3$  is Bank Disc, and is same as Simple Int;  $300 - 1^{\text{st}}$  is P. Worth  
2nd Ex. - A Note for \$300 dated Jan 1 - is at 30 days bear-  
ing Int. @ 5% is Discounted Jan. 19th @ 6%.

Work: - Int on \$300 for 33 days at 5% = \$1.36  
This Int \$1.36, is added to Face \$300 - Amt. due on due date \$301.36. Int on this \$301.36 for time note still had to run, 15 days at 6% = .74  
The amt. \$301.36 - .74 = \$300.62 P. Worth of Note

## True Discount.

Ex. What is the True Disc. on a debt due in 90 days - Amt \$500, money being worth 6%?

Work. - Amt of \$100 for 90 days at 6% = \$1.01  $\frac{25}{100}$ ;  
now divide the total amt. \$500, by amt. of \$100 or \$1.01  $\frac{25}{100}$   
 $500 \div 1.01 \frac{25}{100} = 493.71$ ; this is P. Worth and  $500 - 493.71$  or  $7.29$  is the True Disc.

## Trade Discount.

Ex. List Price is \$360 subject to discounts 20% 10% & 5%; find Net Price

\$360.00 List Price
72.00 - 20% of 360
288.00
28.80 - 10% of 288
259.20
12.96 - 5% of 259.20
<u>246.24 - Net Price.</u>

\$360 - 246.24 = 113.76 Disc.  
Notice 20% is 2 times 10% of a No.  
& 5% =  $\frac{1}{2}$  " 10% " " "

## Cash or Merchandise Discount

Ex. Invoice for \$324.50 Terms 2% 10 days, net 60 days.  
If paid inside 10 days 2% of \$324.50 is deducted  
 $324.50 - 6.49$  or  $318.01$  is Cash Price

Note - In case of Note, in Canada, use 365 days to yr. & Days of Grace.

## Marking Goods

This custom is among merchants in marking goods to use a word or an arrangement of characters they call the key. This is to keep from the customer the cost price of the goods. Taking the word

customary - a

1 2 3 4 5 6 7 8 9 - 0

c stands for 1, w for 2 etc. determine the cost of goods marked as follows. —

csm; sts; amt; vat; yts; atom  
may; rats; toy; mat; army; star.

## More Useful Rules

Bricks - 8" x 4" x 2" is usual size. 22½ bricks make 1 cu ft of wall (allowing ½ for mortar). Laid flat, 4½ bricks make 1 sq ft of wall.

Rafters. - To find length, if roof has  $\frac{3}{4}$  pitch, multiply width of building by .6 (or  $\frac{3}{5}$ ); for  $\frac{1}{2}$  pitch multiply by .7.

Shingles, at 4" to the weather, 9 cover 1 sq. ft

At  $4\frac{1}{2}$ " " " " " " " " " " " "

Allowing for waste figure on 10 to 1 " " " " or 1000 per square (100 sq ft)

Word To find cords divide number of cu ft by 128

Silo, Tank or Cistern, - Capacity in gallons equals square of mean diameter multiplied by the depth, multiplied by  $5\frac{1}{8}$ .

Coal. One Ton contains about  $36\frac{1}{2}$  cu ft.

Hay. - One Tow contains 540 cu. ft. of New Hay;  
512 cu. ft. of Old Hay; and 270 cu. ft. Baled Hay.



## Business Abbreviations

and Symbols

et = that is

e.g. = for example

viz = namely

via = by way of

ft = feet or fathoms

col = collect on delivery

bbl = barrel (or bib)

hhd = hoghead

therefore

= and or because

= foot or feet

= inches

= check mark

$1^2$  = 1 square; or  $1^2 = 1\frac{1}{2}$  yds

$1^3$  = 1 cubed; or  $1^3 = 1\frac{3}{4}$  yds; \$ = Dollar; ¢ = cents.

% = per cent; % = account; % = account sales;

% = care of; O = circumference

% = 5 shillings, 6 pence

C = 100; D = 500; M = 1000;

\*12 = number 12 when written before the figure

12\* = 12 pounds; " after "

The Common Signs are worked in the following order: first of them either 'x' or '+' finally + or -. The part within the bracket is considered as one quantity.

## Some Simple Summs

Ambition + Preparation + Determination = Success

Laziness + Anything else = Failure

Energy x No. of Days in Year = A Good Salary.

24 hrs - 8 hrs for work = 16 hrs for idleness

One Man's Work ÷ 3 People = Nothing done well.

One Week's Savings x 52 each year = The best

New Year's resolution.

Inherited Fortunes x Generations ÷

5 Young sports - brains = 5 - I disto

## COMMON-SENSE OBSERVATIONS



1. That common fractions are uncommon, those with 2, 3, 4, 6 and 8 alone as denominators finding extended use (for others the nearest 2 place decimal is used).

2. That quantities are usually expressed in one or two denominations. The merchant sells  $1\frac{3}{4}$  yards, not 1 yd. 2 ft. 3 in.; the grocer  $1\frac{1}{2}$  lbs., not 1 lb. 8 oz.; the engineer measures in feet and hundreds of feet—the decimal system—not in rods, yards, feet, etc.

3. That employees waste time, energy, and, frequently, costly stationery in unnecessary paper calculations. Yet mental calculation once a habit is always easier.

4. That in actual business, a single Real Estate problem may involve percentage, interest, taxes, commission and insurance.

5. That actual problems are frequently so expressed as to make it necessary to see as well as to solve them. A book says, "I bought 40 chairs, \$8.40 less 15 per cent. discount, paying freight \$11.20, terms 30 days, 2 per cent. cash. If cash is paid find the market price to gain 15 per cent." A similar problem given by dealer to his clerk is, "John, we want to clear 15 per cent. on this invoice," handing him a bill; and John noted terms, discount price, allowance for freight and store burden, and marked his chairs. The employer says "Do this"—the clerk must make the problem.

6. That the use of ruled forms requiring extensions and calculations are increasing rapidly.

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